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RADIATION-ASSOCIATED CANCER IN UTAH FROM 1973 TO 2001

PREPARED FOR

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RADIATION-ASSOCIATED CANCER IN UTAH FROM 1973 TO 2001

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EXECUTIVE SUMMARY

From January 1951 to July 1962, the United States Atomic Energy Commission conducted nearly 100 above-ground nuclear detonations at the Nevada Test Site. Nuclear fallout from these tests exposed nearby residents, known as “downwinders,” to dangerous amounts of radiation. In 1990, Congress passed the Radiation Exposure Compensation Act (RECA) to compensate victims of U.S. nuclear testing, including downwinders.

RECA’s eligibility criteria have long been the subject of controversy. Under the law, residents of 10 southwest counties in Utah are eligible to receive compensation, while residents of 19 other counties in Utah are ineligible. Hundreds of Utah residents with radiation-associated cancers have been denied compensation because they live outside RECA’s boundaries.

At the request of Rep. Jim Matheson, the Special Investigations Division examined new information about cancer rates in Utah. This new information, which was compiled by the National Cancer Institute, includes data on the rates of radiation-associated cancers by county in Utah from 1973 to 2001. It shows that radiation-associated cancer is actually more common in counties where residents are excluded from compensation than in those counties where residents are included under the RECA law.

As described in this report, the new data shows:

- **Over a nearly 30-year period, overall rates of radiation-associated cancers were 8% higher in RECA-ineligible counties.** Where residents can apply for compensation, the rate of radiation-associated cancers was 195 cancers per 100,000 people. But where residents are automatically rejected, the rate was 212 cancers per 100,000 people. Six counties have cancer incidence rates above the state average. Five of these counties are outside of RECA’s borders.
- **Over time, rates of radiation-associated cancers were consistently higher in RECA-ineligible counties.** This pattern was consistent across every five-year increment from 1973 to 2001, using all available data from the National Cancer Institute.
- **Nearly all radiation-associated tumor types were more common in RECA-ineligible counties.** Of 18 types of cancer associated with radiation, 16 were more common in areas where residents are ineligible for RECA compensation. These include each of the five most common

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cancer types: breast cancer, lung cancer, colon cancer, bladder cancer, and lymphoma.

- **Utah counties with higher rates of radiation-associated cancer experienced greater exposure to radioactive fallout.** Recent estimates released by the National Cancer Institute show that there was significant exposure to nuclear fallout across Utah. At the county level, these exposure estimates correlate with the cancer rates released in this report.

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I. BACKGROUND

From January 1951 to July 1962, the United States Atomic Energy Commission conducted nearly 100 above-ground nuclear detonations at the Nevada Test Site. These tests exposed workers and nearby residents, known as “downwinders,” to nuclear radiation, which damages genetic material throughout the body and increases the risk of cancer over time.¹

In 1990, Congress passed the Radiation Exposure Compensation Act (RECA) to compensate victims of U.S. nuclear testing. The Act recognized that “fallout emitted during the Government’s above-ground nuclear tests in Nevada exposed individuals who lived in the downwind affected area in Nevada, Utah, and Arizona to radiation that is presumed to have generated an excess of cancers among these individuals.”²

RECA contains specific eligibility rules for compensation. One rule pertains to the type of harm suffered. Only individuals with 19 types of cancers that can be caused by radiation can receive compensation from the program.³

Another eligibility rule addresses geographic location. In Utah, those who were residents of ten southwest counties during the time of testing are eligible for compensation. Residents of 19 other counties, containing the majority of the state’s population, are ineligible (Map 1).⁴

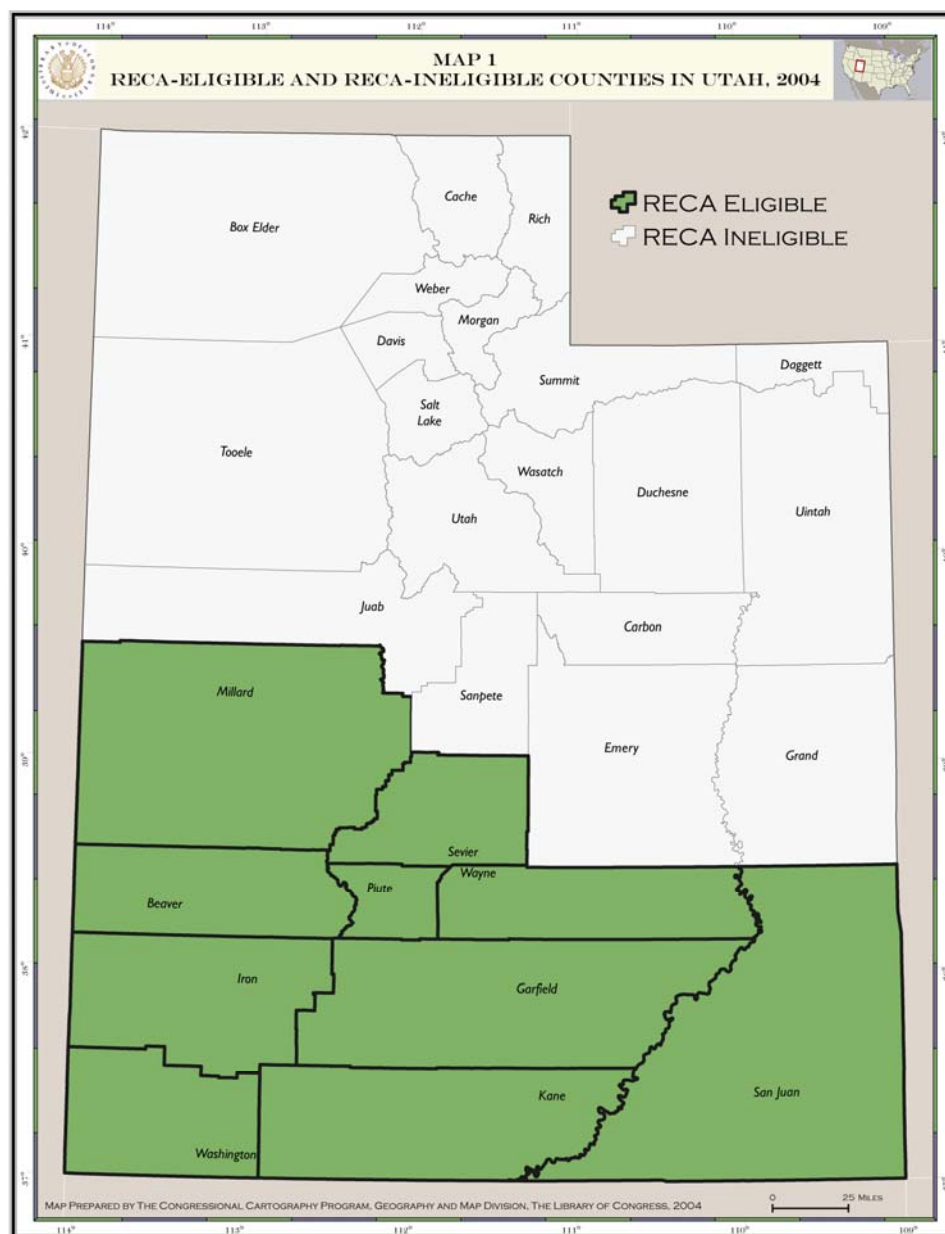
¹ Ethel S. Gilbert, Charles E. Land, and Steven L. Simon, *Health Effects from Fallout*, Health Physics, 726-35 (May 2002).

² Radiation Exposure Compensation Act (42 USC §2210).

³ The Act provides compensation for the following types of primary cancers: leukemia (other than chronic lymphocytic leukemia), thyroid, breast, pharyngeal, esophageal, stomach, small intestinal, pancreatic, multiple myeloma, Non Hodgkin’s lymphomas, gall bladder and biliary, liver (except if cirrhosis or hepatitis B is involved), salivary gland, urinary bladder, brain, colon, ovarian, and lung cancers (other than in situ lung cancer that is discovered during or after a post-mortem exam).

⁴ The ten eligible counties are Beaver, Garfield, Iron, Kane, Millard, Piute, San Juan, Sevier, Washington, and Wayne. The nineteen ineligible counties are Box Elder, Cache, Carbon, Daggett, Davis, Duchesne, Emery, Grand, Juab, Morgan, Rich, Salt Lake, Sanpete, Summit, Tooele, Uintah, Utah, Wasatch, and Weber.

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The exclusion of more than half of Utah's residents from RECA compensation was not well justified at the time of the law's passage. According to the Congressional Research Service, public records at the time of the law's passage do not provide "an explicit rationale for the eligible area's boundaries."⁵ Over the subsequent decade, there has been rising concern that RECA's boundaries are too limited. More than 600 applicants for compensation as downwinders have been rejected on the grounds that their residency did not meet

⁵ Congressional Research Service, *Downwinders' Compensation: Eligible Geographic Area* (Feb. 17, 2004).

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RECA requirements.⁶ Many more Utah residents with radiation-associated cancers who live in RECA-ineligible counties may not have applied.

In 1997 and 2001, the National Cancer Institute released major reports finding evidence of radiation exposure across all of Utah, with the distribution of fallout largely unrelated to RECA's borders. In fact, the National Cancer Institute determined that downwinders who lived in 7 of the 10 Utah counties with the highest estimated radiation exposure are ineligible for RECA compensation.⁷ These findings were presented in October 2003 to a committee of the National Academy of Sciences that is studying RECA's boundaries.

At the request of Rep. Jim Matheson, the Special Investigations Division of the minority staff of the Government Reform Committee examined new data from the National Cancer Institute on the rates of radiation-associated cancers in Utah counties over a nearly 30-year period. Several older studies from the 1970s and 1980s found an increased risk of cancer in southwest Utah, but each discussed different areas of the state and had methodological limitations.⁸ This report is the first comprehensive analysis of the pattern of radiation-associated cancer in Utah and its implications for RECA eligibility.

II. METHODOLOGY

The Special Investigations Division requested and obtained detailed cancer data from the Surveillance, Epidemiology, and End Results (SEER) program run by the National Cancer Institute. SEER is a set of population-based cancer registries that track all cancers diagnosed among residents of their geographic area. Data from the state of Utah were used for this study. The earliest available data came from 1973 and the most recent from 2001.

⁶ E-mail communication from Legislative Affairs, Department of Justice, to minority staff, Government Reform Committee (Apr. 5, 2005).

⁷ Steven L. Simon, *Presentation to the National Academy of Sciences, Committee on Assessment of Scientific Information for the Radiation Exposure Screening and Education Program* (Oct. 9, 2003).

⁸ See, e.g., J. Lyon et al, *Childhood Leukemias Associated with Fallout from Nuclear Tests*, New England Journal of Medicine, 397–402 (Feb. 22, 1979); C. Land, *The Hazards of Fallout or of Epidemiological Research*, New England Journal of Medicine, 431–2 (Feb. 22, 1979); C. Land, F. McKay, S. Machado, *Childhood Leukemia and Fallout from the Nevada Tests*, Science 139–44 (Jan. 13, 1984); C. Johnson, *Cancer Incidence in an Area of Radioactive Fallout Downwind from the Nevada Test Site*, Journal of the American Medical Association, 230–236 (Jan. 13, 1984); S. Machado, C. Land, F. McKay, *Cancer Mortality and Radioactive Fallout in Southwestern Utah*, 44–61 (Jan. 1987); W. Stevens et al., *Leukemia in Utah and Radioactive Fallout from the Nevada Test Site*, Journal of the American Medical Association, 585–591 (Aug. 1, 1990).

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The National Cancer Institute provided data on all cancers types that are eligible for compensation under RECA.⁹ These cancer types are referred to in this report as “radiation-associated cancers.” The data were provided as age-adjusted rates per 100,000 people for 5-year increments from 1973 to 2001, both by county and by groups of counties (RECA-eligible versus RECA ineligible).¹⁰

The Special Investigations Division used these data to compare cancer rates in RECA-eligible and RECA-ineligible counties in Utah.

The Special Investigations Division also examined the relationship between the counties’ cancer rates and estimated exposure to nuclear fallout. For this analysis, estimates of exposure were obtained from the National Cancer Institute’s presentation to the National Academy of Sciences in October 2003.¹¹

III. FINDINGS

A. Overall Rates of Radiation-Associated Cancers Are Higher in RECA-Ineligible Counties in Utah

Over the almost 30 year period (1973–2001) for which the National Cancer Institute has tracked cancer rates, there was an 8% higher rate of radiation-associated cancers in areas where residents cannot obtain RECA compensation than in areas where residents are eligible for compensation. Among residents in RECA-ineligible counties, the rate of radiation-associated cancers was 212 per 100,000 people, compared to 195 per 100,000 people in RECA-eligible counties.

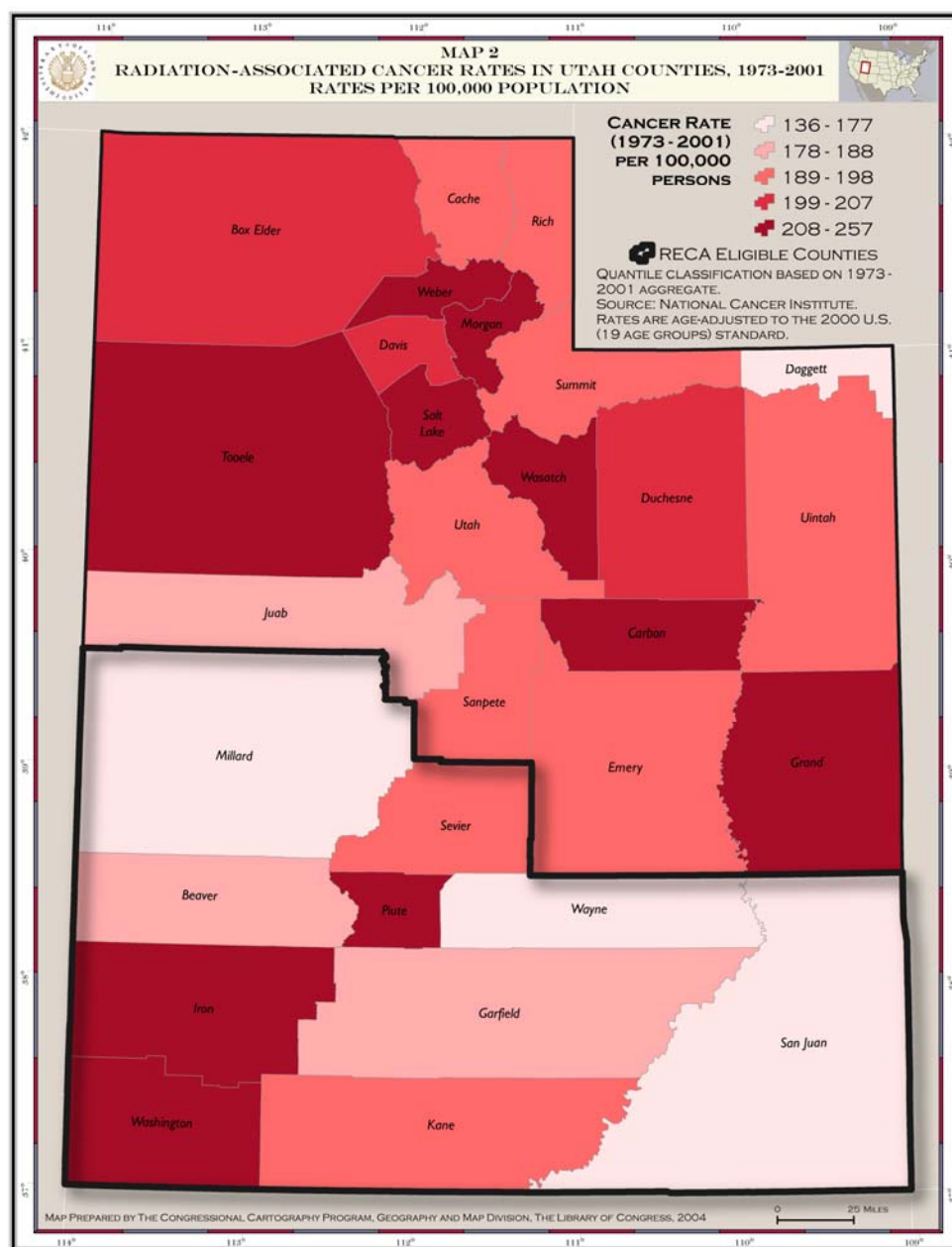
Rates of radiation-associated cancers did not correlate geographically with RECA boundaries (Map 2).

⁹ Cancers included in the study were leukemia (other than chronic lymphocytic leukemia), thyroid, breast, pharyngeal, esophageal, stomach, small intestinal, pancreatic, multiple myeloma, Non Hodgkin’s lymphomas, gall bladder and biliary, liver, salivary gland, urinary bladder, brain, colon, ovarian, and lung cancers.

¹⁰ The age adjustment was performed to a 2000 U.S. standard, using 19 age groups.

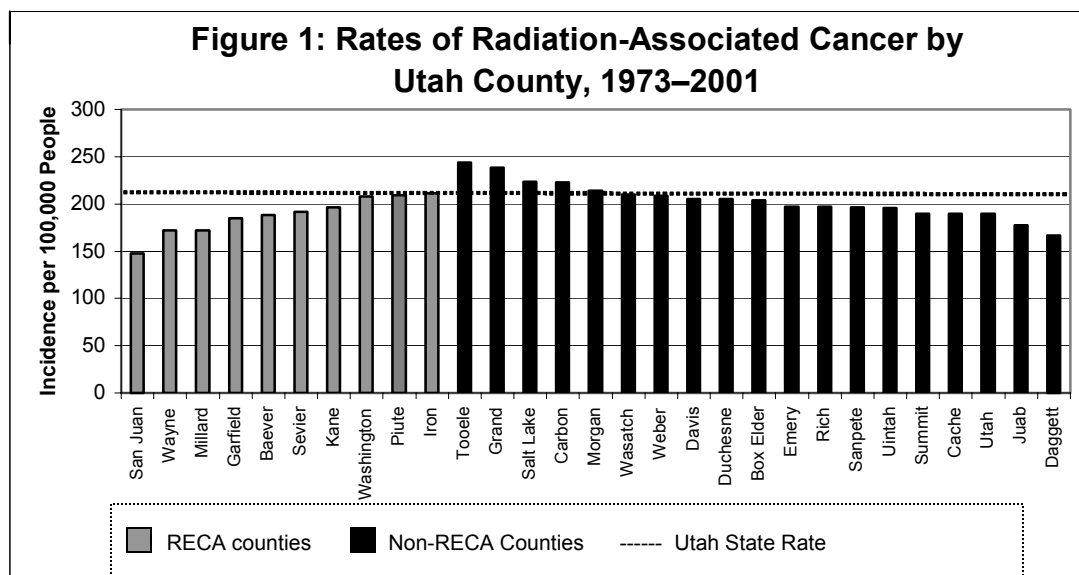
¹¹ Steven L. Simon, *supra* note 7. This presentation included estimates of exposure by county for all isotopes from 1951 to 2000. For several counties, the data was provided for sections of the county, rather than for the entire county. Where this was the case, the Special Investigations Division used the radiation exposure figure for the most populous county section to represent the entire county. To assess the correlation between exposure and rates of cancer, the statistical test used was a Spearman’s test of correlation. Because of the assumption that increased exposure would be associated with higher rates of cancer, a one-tailed test of significance was chosen.

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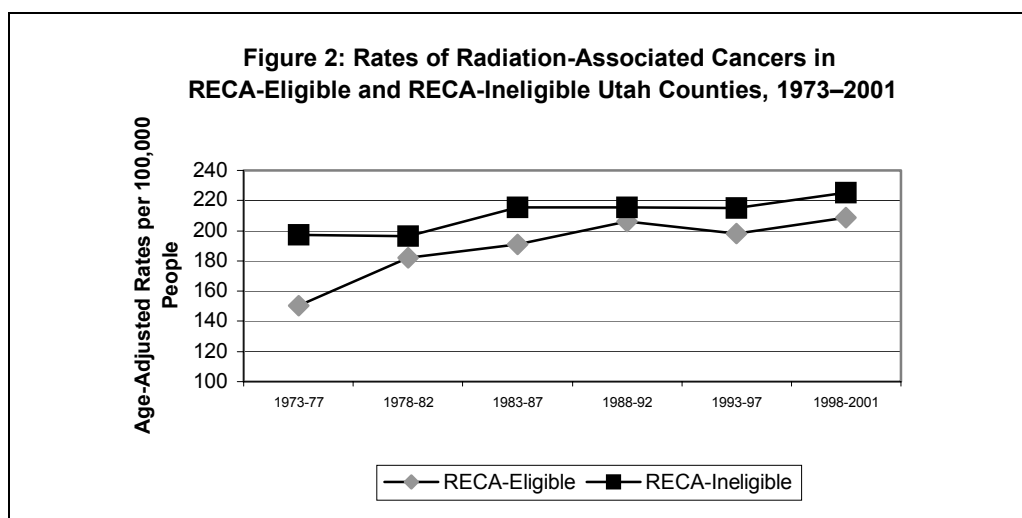
The overall average rate of radiation-associated cancer was 210.5 per 100,000. Six counties in the state had rates that exceeded this average. Five of these are RECA-ineligible counties. The three counties with the highest rates of radiation-associated cancer were Tooele County (243.6), Grand County (238.2), and Salt Lake County (223.8). Residents in all three counties are ineligible for RECA compensation (Figure 1).

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B. Over Time, Rates of Radiation-Associated Cancers Are Consistently Higher in RECA-Ineligible Counties Compared to RECA-Eligible Counties

For every five-year period from 1973 to 2001, rates of cancers associated with radiation exposure were higher in RECA-ineligible counties than in RECA-eligible counties (Figure 2).



C. Nearly All Tumor Types Are More Common in RECA-Ineligible Counties Than in RECA-Eligible Counties

Of 18 types of cancer associated with radiation exposure and compensated under RECA, 16 were more common in RECA-ineligible counties than in RECA-eligible counties in Utah. These included each of the five most common types of radiation-associated cancer: breast cancer, lung cancer, colon cancer, bladder cancer and lymphoma (Table 1).

Tumors of the salivary gland were equally common in the two sets of counties, and tumors of the esophagus were slightly more common in RECA-eligible counties (2.4 per 100,000 compared to 2.3 per 100,000).

Table 1: Rates of Specific Types of Radiation-Associated Cancers in RECA-Eligible and RECA-Ineligible Utah Counties, 1973–2001 (Rates per 100,000)		
Cancer Type	RECA-Ineligible	RECA-Eligible
Bladder	16.5	16.0
Brain	6.4	5.6
Breast	58.4	51.2
Colon	31.3	27.9
Esophagus	2.3	2.4
Gallbladder and Other Biliary	2.4	2.0
Liver and Intrahepatic Bile Duct	2.5	2.3
Lung	31.1	30.8
Myeloma	4.9	4.8
Non-CLL Leukemia	8.3	8.2
Non-Hodgkins Lymphoma	15.3	15.1
Ovary	7.9	7.8
Pancreas	8.9	7.9
Pharynx	1.0	0.8
Salivary Gland	1.3	1.3
Small Intestine	1.5	0.9
Stomach	7.0	5.4
Thyroid	6.6	5.9

D. Utah Counties with Greater Exposure to Radioactive Fallout Experience Significantly Higher Rates of Radiation-Associated Cancer

In October 2003, the National Cancer Institute presented data to the National Academy of Sciences estimating exposure to nuclear fallout across the state of Utah, including in counties that are RECA-ineligible. This data shows that of the ten counties in Utah with the highest estimated exposure to all nuclear isotopes from 1951 to 2001, seven are RECA-ineligible.¹²

Comparing the recent exposure data with the new data on cancer rates by county offers the opportunity to assess whether, at the county level, exposure is linked to cancer rates. This comparison reveals that the counties with the highest estimates of exposure were also more likely to have higher rates of radiation-associated cancers. For example, of the seven counties with the least estimated exposure, just one was in the top ten in cancer incidence from 1973 to 2001. Of the seven counties with the greatest estimated exposure, five were in the top ten in cancer incidence. The correlation was statistically significant.¹³

IV. LIMITATIONS TO THE DATA

The findings of this report are based upon aggregate data in Utah counties from 1973 to 2001. This data has several important limitations. First, the cancer rates reflect where individuals lived at the time of diagnosis, not at the time of exposure. As a result, substantial movement between counties could hide a geographic pattern of cancer.

Second, the rates are likely to include some cancers of individuals who never were exposed to above-ground nuclear testing because of younger age or late migration to the area. The inclusion of these individuals could dilute a true geographic pattern of cancer due to radiation exposure.

¹² The seven RECA-ineligible counties among the top 10 exposed to radiation are Utah, Tooele, Morgan, Davis, Weber, Salt Lake, and Summit. Steven L. Simon, *supra* note 7.

¹³ Spearman's correlation coefficient = 0.3161. P value for one-tailed test of significance: p = 0.047.

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Third, the rates do not control for other important factors that affect cancer rates such as smoking. While smoking rates are low overall in Utah,¹⁴ if such factors are distributed unequally among counties, a clear geographic pattern of cancer could be hidden.

Fourth, the overall association between radiation exposure and radiation-associated cancer should be considered a preliminary finding. An assessment of causality requires review of studies based on individual exposure. Such a review is beyond the scope of this analysis.

While significant, these limitations should be considered in context. Utah's population is considered relatively stable, and it is likely that many residents remained in their counties after being exposed to radiation from the Nevada test site. Because cancer rates generally increase with age, the contribution of younger patients to the cancer rates can be expected to be small. The consistency of the results across time and types of cancer suggests that it is highly unlikely that the data missed a striking increase in radiation-associated cancer in RECA-eligible counties. Finally, the statistically significant correlation between the most recent data on exposure and the most recent data on cancer rates, while not definitive, lends additional support to the findings.

V. CONCLUSION

It is known that residents of RECA-ineligible counties in Utah were exposed to substantial levels of nuclear fallout from the Nevada test sites. This report presents new evidence that these residents have also experienced higher rates of radiation-associated cancer. These findings provide support for expanding RECA's boundaries.

¹⁴ In 2002, 12.7% of Utah residents smoked cigarettes, compared to a national average of 22.5%. Henry J. Kaiser Family Foundation, *Utah: Cigarette Smoking Rate for Total Population, 2002* (online at www.statehealthfacts.org).